by Gordon West, WB6NOA

X-Band Ham Excitement

The amateur radio X-band has been allocated a whopping 500 MHz; 10,000 through 10,500 MHz. This band is abbreviated 10 GHz, and sometimes is listed as the 3-cm band. Wideband FM, narrowband single sideband, CW, and phase shift keying, along with amateur wideband television, are just a few of the emissions you might find on this relatively secluded microwave band.

Alaskan hams get their first look at 10,000 MHz radios. (Photo by Ray Solomon).

Until The Moon Comes Up . . .

Amateur radio operators throughout the world bang out successful contacts off of the moon using dish antennas and hot dog cooking power levels from traveling wave tube amplifiers that feed waveguide that terminates to a feed horn precisely positioned for the best pattern coming from the dish. To these ham radio moonbouncers, a 10,000-MHz contact over thousands of miles of space is an almost everyday deal.

But there is plenty of excitement at 10,000 MHz without a huge dish, nor any significant power levels above a half-watt output. Last September in Southern California, a new world record terrestrial contact that lasted several minutes was exchanged between a maritime mobile station off of Baja, California, to a relatively small low-power dish system, mountain topping, in Southern California. When conditions are just right on 10,000 MHz, range enhancement from tropospheric ducting may easily carry these radar band signals well in excess of 500 miles. In fact, the August and September 10,000 MHz operating contests regularly posted operators using just a few hundred milliwatts of equipment and logging narrowband and wideband voice contacts in excess of 300 miles with simple horn antennas connected to flexible waveguide.

License Requirements

All levels of amateur radio licenses may operate on the 10,000-MHz X-band, including no-code Technician class operators. The simple Element 2 Technician class test is easily passed by studying the actual test questions and multiple-choice answers, along with a brief description of why the test question is relevant to the world of ham radio. Any RadioShack will have the **Element 2 West book,** which takes about 45 days for a thorough reading and understanding to pass the 35-question, multiple-choice exam. And you don't have to pass the Tech test 100 percent — you can miss up to nine questions and still squeak through. It usually takes only seven days to receive your call letters.

If you're eager to get on the air at 10,000 MHz, you can go with a complete wideband FM X-band transceiver, fully tuned and assembled, from Advanced Receiver Research (www.advancedreceiver.com). Just add 12 volts and a simple crystal microphone, and you are on the air to any other wideband FM station. (Easier said than done!) The little ARR transceiver has both an S-meter for measuring signal strength to assist in aiming the horn, plus a voltage readout of the voltage-controlled oscillator so you can begin linking up with another FM X-bander.

Since the X-band microwave operating weekends are still months away, ask around at your local club or get onto your favorite 2-meter repeater and see who else has wideband 10 GHz gear. Then go to a club meeting, and turn on your rigs while one station transmits and the other station tunes around for best reception. Even with as little as 1/10th of a watt, always observe RF safety by never looking into the open horn, or putting your body in front of the waveguide feed system. It's also best to point your equipment away from the other system so as not to create overload.

Once you have made an FM contact across the room, try your luck at a block away, then five blocks away, but don't expect to see much more range on wideband FM than 10 blocks away. It's not that the signals don't go any further than 10 blocks, but rather the major amount of foliage and building absorption at this microwave band.

Ten blocks range on X-band STINKS! I couldn't agree more, especially after spending several hundred dollars for your ARR X-band transceiver. So your next move is for you and your buddy with similar wideband FM equipment to do a little mountain topping — say 20 miles apart. Twenty miles will be an easy shot on FM, but it will underscore the need for 2-meter simplex

Hawaii's KH6HME 10,000 MHz beacon station. (Photo by Gordon West).

The Alaska aurora provided an exciting 10,000 MHz buzz echo! (Photo by The Mockermans).

or FRS liaison radio equipment. I like 2-meter simplex the best because I always know if I can hear a low-power 2-meter signal on my 2-meter handheld to the other 2-meter low-power handheld. I most likely will be able to establish the 10-GHz path. But if I can't make it on 2 meters, low-power simplex, forget about even looking for the 10,000-MHz path — it just won't be there, probably due to something in between like a tall building or a big tree.

On wide-band FM with 200 milliwatts, you could easily get tropospheric ducting between mountaintops in excess of 70 miles. I once did an over-the-water path on 10,000 MHz, wideband FM, using just the small horn and flexible marine radar waveguide to a slightly larger equipped station over 250 miles away — well over the horizon.

Your wideband FM station could also transmit and receive amateur TV signals, point-to-point FM repeater linking, and almost any other type of full duplex simultaneous talk and listen system you want to set up. The ARR equipment is sometimes seen at swap meets, and if you can buy them as a pair, you now have full duplex intercom capabilities at 10,000 MHz without many eavesdroppers!

Narrowband For More Range

Upper sideband is the usual mode for narrowband, 10,000-MHz range extension. Unlike FM running full duplex, your SSB X-band system will be conventional you-transmit and then unkey and listen for a reply on the same frequency. The calling frequency is **10,368.100**, and again, we normally use the 2-meter band as liaison to decide who's going to do the calling first, and who will do the listening and rotation of the horn or dish looking for the signal.

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I thought we might see some all-in-one, 10 GHz, narrow-band, SSB transceivers with the launch of AO-40 satellite, but alas the phase 3D satellite 10 GHz system became victim of the onboard major malfunction, so 10 GHz equipment providers are sticking with TRANSVERTERS that take your 2-meter or 10-meter, multi-mode, SSB radio and pop them up to 10,000 MHz on transmit and receive. Check out:

SSB Electronics: www.ssbusa.com

Down East Microwave: 954 Route 519, French Town, NJ 08825

Directive Systems: Rural Route 1, Box 282 Dixon Road,

Lebanon, ME 04027

Jerry at SSB Electronics (570-868-5643) makes it a point to work with newcomers in lining up the right transverter for equipment already owned. If you have an FT817 from Yaesu, Jerry will have a specific recommendation for a transverter, and he will also let you know easy steps to interface the transverter to your existing rig to lead to push-to-talk SSB and CW capabilities on X-band. Jerry also will talk you through what it takes for the right horn or dish to achieve some spectacular results.

How much further will you talk on X-band when you go from wideband FM to SSB? Hundreds of miles! Hams all over the country running less than a watt *routinely* log 200 and 300 miles QSOs.

Last September I attended the Anchorage and Fairbanks, Alaska, Hamfests. AMSAT's Ed Cole, AL7EB, and I gave many Alaskan hams their first look at 10,000 MHz excitement. He has converted an 18-inch DSS dish that works 10,000 MHz quite nicely. During our demos, Alaska hams heard the effects of Doppler shift quite noticeably with signals bouncing off of big rig trucks speeding down an expressway several hundred feet away. They could also hear the characteristics of 10 GHz rock bounce when we both aimed our antennas at the distant Alaskan snow-capped mountains. We were also gearing up to work well-known Alaskan microwave expert KL7FZ who agrees with us that we need more hams on microwaves in order to hold these frequencies from other radio services claiming squatters rights.

In Southern California and Hawaii, N6CA and KH6HME will try this summer for the ultimate DX, 2,500 miles. The path from California to Hawaii has been worked on lower microwave bands, but not yet at 10,000 MHz.

Ed Cole, AL7EB, (right) is helping Alaska hams learn about 10,000 MHz. (Photo by Ray Solomon).

Gordo demos aircraft scatter, harmlessly bouncing 10,000 MHz off a low-flying Alaska floatplane. The green box on top of the Kenwood radio is the transverter.

If you think 10,000 MHz is way up there, members of the San Bernardino Microwave Society (247 Rebel Road, Ridgecrest, California 93555) and North Texas Microwave Society (www.ntms.org) plus the Central States group all agree that life above 10 GHz flourishes — 47,088.1 as the 12-millimeter band calling frequency, and even higher-than-this microwave bands propagating well over many kilometers.

So if you are a ham and looking for a whole new world of microwave excitement, transvert on up to X-band and set up a schedule with a fellow operator just a few hundred feet away. Then go for blocks, miles, and ultimately hundreds of miles! ■